



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

24 CFR Parts 3285 and 3286

**[Docket No. FR-5631-P-01]
RIN 2502-AJ15**

**Model Manufactured Home Installation Standards:
Ground Anchor Installations**

AGENCY: Office of the Assistant Secretary for Housing – Federal Housing Commissioner, HUD.

ACTION: Proposed Rule.

SUMMARY: This proposed rule would amend the Manufactured Home Model Installation Standards by adopting recommendations made by the Manufactured Home Consensus Committee to revise existing requirements for ground anchor installations and establish standardized test methods to determine ground anchor performance and resistance. The performance of conventional ground anchor assemblies is critical to the overall quality and structural integrity of manufactured housing installations. While HUD's Model Manufactured Home Installation Standards reference a nationally recognized testing protocol for ground anchor assemblies, there is currently no national test method for rating and certifying ground anchor assemblies in different soil classifications. This proposed rule would establish a uniform test method that could be used by all states for rating and certifying the performance of ground anchor assemblies.

DATES: Comment Due Date: **[Insert date 60 days from the date of publication in the FEDERAL REGISTER].**

ADDRESSES: Interested persons are invited to submit comments regarding this rule to the Regulations Division, Office of General Counsel, Department of Housing and Urban Development, 451 Seventh Street, SW, Room 10276, Washington, DC 20410-0500.

Communications must refer to the above docket number and title. There are two methods for submitting public comments. All submissions must refer to the above docket number and title.

1. Submission of Comments by Mail. Comments may be submitted by mail to the Regulations Division, Office of General Counsel, Department of Housing and Urban Development, 451 7th Street, SW, Room 10276, Washington, DC 20410-0500.

2. Electronic Submission of Comments. Interested persons may submit comments electronically through the Federal eRulemaking Portal at www.regulations.gov. HUD strongly encourages commenters to submit comments electronically. Electronic submission of comments allows the commenter maximum time to prepare and submit a comment, ensures timely receipt by HUD, and enables HUD to make them immediately available to the public. Comments submitted electronically through the www.regulations.gov website can be viewed by other commenters and interested members of the public. Commenters should follow the instructions provided on that site to submit comments electronically.

Note: To receive consideration as public comments, comments must be submitted through one of the two methods specified above. Again, all submissions must refer to the docket number and title of the rule.

No Facsimile Comments. Facsimile (FAX) comments are not acceptable.

Public Inspection of Public Comments. All properly submitted comments and communications submitted to HUD will be available for public inspection and copying between 8 a.m. and 5 p.m., weekdays, at the above address. Due to security measures at the HUD

Headquarters building, an advance appointment to review the public comments must be scheduled by calling the Regulations Division at 202-708-3055 (this is not a toll-free number). Individuals with speech or hearing impairments may access this number through TTY by calling the Federal Information Relay Service at 800-877-8339. Copies of all comments submitted are available for inspection and downloading at www.regulations.gov.

FOR FURTHER INFORMATION CONTACT: Henry S. Czauski, Acting Deputy Administrator, Office of Manufactured Housing Programs, Office of Housing, Department of Housing and Urban Development, 451 7th Street, SW, Room 9164, Washington DC 20410; telephone number 202-708-6409 (this is not a toll-free number). Persons with hearing or speech impairments may access this number through TTY by calling the toll-free Federal Relay Service at 800-877-8339.

SUPPLEMENTARY INFORMATION:

I. Background

The National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. 5401-5426) (the Act) authorizes HUD to establish the Federal Manufactured Home Construction and Safety Standards (the Construction and Safety Standards, or Standards) codified in 24 CFR part 3280. The Act was amended in 2000 by the Manufactured Housing Improvement Act of 2000 (Pub. L. 106-569), which expanded the purposes of the Act and created the Manufactured Housing Consensus Committee (MHCC). The Manufactured Housing Improvement Act also authorized the Department to establish Model Installation Standards and program requirements pertaining to the installation of new manufactured homes, and assigned responsibility to the MHCC to develop and submit to the Secretary proposed model manufactured home installation standards.

The MHCC began work on its installation standards recommendations in 2002. In August 2005, as part of that standards development process, the Installation Subcommittee of the MHCC developed a draft Ground Anchor Assembly Test Protocol (GAATP). Because of past concerns regarding ground anchor performance, identified during prior research conducted by the Department, and since the draft GAATP had not been independently validated, HUD elected not to include the proposal in the Model Manufactured Home Installation Standards final rule, which was published on October 19, 2007 (72 FR 59338). Instead, HUD sponsored an extensive literature review and multisite ground anchor testing study to verify the adequacy of the draft testing protocol and to determine whether any areas in the draft GAATP required change or enhancement to improve reliability. HUD's ground anchor assembly site study is available on the HUD user database at

http://www.huduser.org/portal/publications/detech/grnd_anchor_2d.html.

Because there was no nationally recognized testing protocol in 2005 that was universally accepted for testing and certifying ground anchor assemblies in different soil classifications throughout the country, HUD elected to include a provision in § 3282.402 to act as a place-marker in the Model Installation Standards while the research was being completed.

II. Ground Anchor Verification Testing

A. Background

Ground anchors consist of a specific assembly designed to transfer home anchoring loads to the ground. Ground anchors are used extensively in manufactured housing installations and are economical, readily available, and can be installed with relatively lightweight tools and equipment. Anchors are typically constructed with a circular shaft of one or more helixes. A head connects at the opposite side of the anchor which then connects with the home's frame or

sidewalls. Helical anchors are designed to be augured into the ground and may also be installed with stabilizer plates to increase the lateral capacity of the anchor.

One significant limitation of ground anchors arises from multiple soil-anchor response mechanisms as a function of soil type, anchor depth, and load configuration. In cohesive soils, excessive anchor movements in a vertical direction can approach or exceed the soil's shear strength. In such cases, the ground anchor is supported by the soil's residual shear strength, resulting in a decrease in anchor capacity. In granular soils, large lateral movements may produce failure planes that can reduce the strength in the vertical direction. In either case, ground anchor movements of several inches can have significant negative impacts on long-term performance and the safety of the home.

B. Ground Anchor Assembly Site Study

The ground anchor assembly site study was conducted to provide HUD with an assessment of the draft GAATP using various ground anchor assemblies, test configurations, and under different site soil conditions. A new test rig was developed for the field testing program in order to facilitate an efficient and repeatable method of ground anchor testing. A total of 74 conventional anchors were tested, at three different locations, with the testing rig developed for the project. An additional 30 duplicate tests were conducted at the Georgia test site using one of the anchor manufacturers testing apparatus for comparative testing purposes. Overall, 104 tests were performed.

Ground anchor resistance varies significantly based on the type of soil in which the anchor is embedded, and is significantly lower in weaker soil conditions. One of the major issues examined in the study was the impact and reliability of anchor performance when the type of site soil was determined by the Unified Soil Classification System (USCS) recommended in

the draft GAATP and § 3285.202, as compared to other soil testing methods. The test data from the study found that the USCS was generally a very poor indicator of ground anchor performance and should not be relied upon to determine anchor resistance, unless a significantly higher factor of safety is used to rate the anchor.

Although there were major differences between the project test rig and the lever arm test rig employed by the anchor manufacturer, similar results were achieved in the comparative testing of duplicate anchors that was performed between the two testing approaches. Those differences in the anchor manufacturer's test rig were related to lack of load or displacement control, relaxation of the soil around the test anchor, in the support foot of the rig being within the cone of influence of the soil around the anchor, and in reporting the ultimate load resistance as an instantaneous, rather than sustained load. In addition, the ultimate loads reported using the anchor manufacturer's testing rig were typically about 20 percent higher or less conservative than values obtained using the project test rig.

In the HUD sponsored study, only one of the anchors tested actually achieved the ultimate load testing resistance requirements in the draft GAATP. However, ground anchor manufacturers who witnessed the testing stated that, with properly sized anchors for the soil classifications tested, their anchors would be capable of achieving the ultimate loads and deflection limits required by the draft test protocol. All of the angle pull anchors were tested at a minimum angle of 30 degrees to the ground. This is consistent with the current requirements of § 3285.402 and the earlier findings of field testing performed by ground anchor manufacturers in developing the draft GAATP. The anchor manufacturers' field tests had earlier found that ground anchor assemblies repeatedly failed well below the load resistance levels required by the

draft GAATP, when tested at strap angles of 17-30 degrees. In view of those findings, the HUD sponsored field study only included anchor testing for angles of 30 degrees or greater.

Various improvements to the draft GAATP test procedures were employed in the study and were subsequently recommended to improve reliability and repeatability of ground anchor testing results (see section 5.6 of the Ground Anchor Verification Testing Task 2D Report, Final Report, March 1, 2008). These included the use of a test rig that limits the angle of pull to plus or minus (+/-) two degrees during the angle-pull anchor test and the proximity of the anchor to the test stand supports; use of a maximum and test displacement rate of 0.6 inches per minute; increasing the anchor pre-tension load to 1,000 pounds to set the anchor shaft to the stabilizer plate for angle-pull test configurations; standardizing anchor and stabilizer plate installations; and proper soil characterization at the test site, which did not rely solely on the USSC, such as provided in § 3285.202 of the Model Installation Standards.

III. Changes to the draft GAATP recommended by the MHCC

In 2003, the MHCC identified the need to develop criteria for testing and evaluating ground anchor assemblies used to secure manufactured homes against wind forces at the installation site. Its initial effort resulted in the draft GAATP that was developed by the Installation Subcommittee of the MHCC. Through extensive deliberation at 10, in-person and conference-call meetings of the Committee, review of public input on the draft documents, and consideration of test reports and research conducted by the Department, the MHCC voted unanimously at their March 2011 meeting to recommend that HUD adopt a revised version of its earlier ground anchor assembly testing proposal.

The following modifications were made to the draft GAATP in the MHCC proposal, entitled, “Standard Test Methods for Establishing Working Load Design Values of Ground Anchor Assemblies Used for New Manufactured Home Installations”:

1. The soil test torque probe method would be required to be used in at least three locations to classify the soil at the certification test site (§ 3285.402(b)(3)(ii));
2. For soil classifications 3, 4A, and 4B, site testing would be required to be performed in the lower 50 percentile torque probe value and for soil classifications 1 and 2 the torque probe value would not be permitted to exceed 750 inch-pounds (§ 3285.402(b)(7)(iii));
3. A User Note would be added with regard to the positioning of the test rig supports and their proximity to the anchor assembly being tested (§.3285.402(b)(7)(iii));
4. The number of field tests required would be reduced from a minimum of 6 tests to a minimum of 3 tests, due to improved reliability resulting from certification testing being conducted at the test site by the torque probe method, for the anchor certification to be determined in the lower 50 percentile of the soil classification being tested.
5. The anchor head would be not be able to extend more than 3/4 inch above the stabilizer plate (§ 3285.402(b)(7)(iii));
6. The ground anchor would be permitted to be pretensioned up to 1,000 pounds so the anchor shaft contacts the stabilizer plate, instead of the 500-pound maximum pretensioning force allowed by the draft GAATP (§ 3285.402(b)(8));
7. The load and displacement criteria would be enhanced to require a minimum of five data points with a minimum of 500-1,000 pound increments of loading;
8. The working load design value and soil classification would now be required to be included for each type of anchor installation in the ground anchor assembly listing or certification;

9. A ground anchor tested in a given soil classification number could not be approved for use in a weaker or higher soil classification unless it is also tested in those soil conditions; and
10. The test report would be required to include the soil classification(s), including moisture content and methods for determining soil characteristics for each type of soil for which each ground anchor was evaluated and is certified for use, and the working load design value and minimum ultimate capacity for these soil classification(s).

IV. This Proposed Rule

HUD has reviewed the above described changes to the draft GAATP and the proposal from the MHCC and, other than formatting and editorial changes, is in agreement with these recommendations. The proposed rule would require determination of soil classification by the test probe method, at each testing site for which each anchor assembly is being certified, and would require the tests to be conducted in weaker soils at the lower 50 percentile torque probe value of the soil in which the anchor is being tested. A minimum of three tests must be performed at each certification test site and the anchor assembly must resist at least 4,725 pounds (3,150 pounds x 1.5 factor of safety) in the direction of the pull for each test method for which the anchor is being certified.

The proposed rule includes standard test methods for evaluating ground anchors by the anchor assembly/stabilizer plate test method, the vertical in-line anchor assembly test method, and the in-line ground anchor assembly test method. Failure criteria would be established as a displacement of 2 inches in either the horizontal or vertical direction prior to reaching a total working load of 3,150 pounds, or when the ground anchor head displaces 2 inches in the vertical direction or 3 inches in the horizontal direction prior to reaching a total load of 4,725 pounds, or

when any component of the ground anchor shaft fails prior to reaching a total load of 4,725 pounds.

The proposed rule would require the working load design value for each installation method and soil classification to be reported in the ground anchor assembly listing or certification. The proposed rule would also clarify that an anchor tested in a given soil classification would not be approved for use in a higher or stronger soil classification. The test report required by the proposed rule would include all conditions for each ground anchor assembly tested, the soil classification(s) for which the assembly is certified for use, and the working load design value and minimum ultimate capacity for those soil classification(s).

HUD Questions:

The public is invited to comment on any of the specific provisions included in this proposed rule and is also invited to comment on the following questions and on any other related matters or suggestions regarding this proposed rule:

1. Are three anchor tests at each test certification site sufficient to ensure adequate reliability in rated anchor performance, in view of the variation and impact of soil type on the resistance of ground anchor assemblies, or should a minimum of six tests be required, as initially proposed in the draft GAATP?
2. Should the proposed rule be amended to include test requirements for an evenly controlled rate of anchor displacement (0.5 to 0.6 inches per minute) to prevent higher anchor load resistance from being certified, as found in the comparison tests in the HUD research study?
3. Should anchor certifications performed by a professional engineer be required to include follow-up investigations and/or testing to assure ongoing quality of ground anchor products and assemblies?

V. Costs and Benefits of Proposed Rule

As has been discussed in this preamble, this rule proposes to amend the Manufactured Home Model Installation Standards by adopting recommendations made by the MHCC to revise existing requirements for ground anchor installations. Specifically, the rule would establish a national standard for rating and certifying the performance of ground anchor assemblies. While difficult to predict, HUD has determined that the discounted benefits of the rule, including prevented property damage, personal injury, and loss of life are expected to exceed the estimated, one-time costs of between \$250,000 and \$375,000 imposed by this rule.

Under current practice, ground anchor producers hire third-party certifiers to test the performance of ground anchors in various soil types in order to provide installation instructions. To the extent that producers have not already tested to the proposed standards, they would need to retest and recertify the performance of their ground anchors. No subsequent retesting would be required. Based on estimates provided by one supplier of ground anchors, testing would cost each producer between \$50,000 and \$75,000. This one-time cost includes 2 to 3 days of testing at two different soil class sites, engineering costs for witnessing the tests, and costs for preparing the reports and certifications. There are five ground anchor producers. Thus, the aggregate one-time cost of this rule totals between \$250,000 and \$375,000. The true cost would most likely be near the lower end of this range since Florida has existing ground anchor standards that exceed those proposed in this rule.

The benefits provided by the rule would more than offset these one-time costs. Initially, the proposed standards, once implemented, will reasonably decrease the damage resulting from the failure of anchor systems, particularly during high wind events, including hurricanes and

tornados, and in seismic events. John Krigger¹ reports, for example, that “of the manufactured homes destroyed when Hurricane Andrew hit Louisiana, 55 percent of the structural failures were caused by anchor or tie-down failure.” Similarly, the failure of ground anchor systems also results in collateral property damage to nearby buildings and throughout the community. According to Krigger², 11 percent of manufactured homes failed during Hurricane Andrew because of large missiles (building materials flying through the air) or falling trees. During seismic events, limited primarily to California and Missouri, and high wind events, which due to tornados cover the entire country, failure of ground anchor systems can cause the home to separate from its gas lines, causing the house to explode and nearby buildings can also burn as a result.

According to the U.S. Census Bureau’s Survey of Manufactured Homes, the sales price of a new manufactured home in August 2012 was \$62,600. This provides an upper bound on the value of damage to a single home. Using this upper bound, costs would equal benefits if between 4 and 6 homes were not destroyed in the first year due to the new anchor standards. This is less than 0.02 percent of the total placements in 2011, which totaled 47,000.

The proposed rule might also reduce the number of injuries and deaths resulting from failed ground anchors. Brooks and Doswell³ discuss the annual number of deaths from tornadoes and the particular risk to residents of manufactured homes. Their statistics show that 42 percent of deaths from tornadoes are to residents in manufactured homes. The National Oceanic and Atmospheric Association (NOAA) provides information on the number of fatalities

¹ Krigger, John. “Your Mobile Home: Energy and Repair Guide for Manufactured Housing,” *Saturn Resource Management, Inc.*, June 1, 1998, 224 pages.

² Id.

³ Brooks, Harold and Charles Doswell. 2002. “Deaths in the 3 May 1999 Oklahoma City Tornado from a Historical Perspective” *Weather and Forecasting*, volume 17, 354-361.

and injuries from various weather events. According to NOAA, in 2011, there were 277 deaths of persons in mobile homes from tornadoes. Although it is difficult to estimate the number of deaths that could be prevented by the increased standards in this rule, it is likely that some deaths would be prevented. Government estimates of the value of a human life range from \$6.2 million, used by the Department of Transportation (DOT), to \$9.1 million used by the Environmental Protection Agency (EPA). The DOT estimate is based on the work of Taylor and Mozrek⁴ who examine labor market, or revealed preference, studies. Using the DOT estimate, avoiding one death in the first year would offset the maximum one-time cost (\$375,000) by \$5.7 million. If one death were prevented in the 43rd year after implementation, the one-time cost of \$375,000 would be exceeded, assuming a 7 percent discount rate. Thus, any deaths prevented prior to the 43rd year would yield net benefits from this rule.

Due to the lack of specific data on the damage and deaths caused by failed ground anchors, a precise measure of the prevented damage cannot be calculated. However, based on the above discussion, it appears likely that the benefits would more than offset the one-time costs imposed by this rule.

VI. Findings and Certifications

Paperwork Reduction Act

The information collection requirements contained in this proposed rule have been approved by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501-3520) and given OMB control number 2502-0253. In accordance with the Paperwork Reduction Act, an agency may not conduct or sponsor, and a person is not

⁴ Taylor, Laura and Janus Mozrek. 2002 "What Determines the Value of a Life? A Meta-Analysis" *Journal of Policy Analysis and Management*, Vol. 21, No. 2.

required to respond to, a collection of information, unless the collection displays a currently valid OMB control number.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1531-1538) (UMRA) establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments, and on the private sector. This proposed rule does not impose any Federal mandate on any State, local, or tribal government, or on the private sector, within the meaning of UMRA.

Environmental Review

A Finding of No Significant Impact with respect to the environment has been made in accordance with HUD regulations at 24 CFR part 50, which implement section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)). The Finding of No Significant Impact is available for public inspection between the hours of 8 a.m. and 5 p.m., weekdays, in the Regulations Division, Office of General Counsel, Department of Housing and Urban Development, 451 Seventh Street, SW, Room 10276, Washington, DC 20410-0500.

Executive Order 13132, Federalism

Executive Order 13132 (entitled “Federalism”) prohibits, to the extent practicable and permitted by law, an agency from promulgating a regulation that has Federalism implications and either imposes substantial direct compliance costs on State and local governments and is not required by statute, or preempts State law, unless the relevant requirements of section 6 of the Executive Order are met. This rule does not have Federalism implications and does not impose substantial direct compliance costs on State and local governments or preempt State law within the meaning of the Executive Order. The Model Installation Standards by themselves do not

affect governmental relationships or distribution of power. Therefore, HUD has determined that the Model Manufactured Home Ground Anchor Installation Standards do not have Federalism implications that warrant the preparation of a Federalism Assessment in accordance with Executive Order 13132.

Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements, unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. HUD has conducted a material and labor cost impact analysis for this rule. The potential cost impact would be based on costs associated with re-testing and listing or certifying current ground anchor assemblies in accordance with the proposed testing methods. The average per-home cost, estimated to be approximately \$0.30 to \$0.50 per anchor multiplied by an average of 16 anchors per home, multiplied by 50,000 homes produced in a year, is about \$250,000 to \$375,000 annually. This includes possible additional costs that may be incurred for redesign of existing anchor assemblies that may be needed to meet the testing requirements of the proposed rule. This does not represent a significant economic effect on either an industrywide or per-unit basis. This small increase in cost associated with this proposed rule would not impose a significant burden for a small business.

Notwithstanding HUD's determination that this rule would not have a significant economic effect on a substantial number of small entities, HUD specifically invites comments regarding any less burdensome alternatives to this rule that would meet HUD's and Federal statutory objectives.

Catalogue of Federal and Domestic Assistance

The Catalogue of Federal and Domestic Assistance number is 14.171.

List of Subjects

24 CFR Part 3285

Housing standards, Incorporation by reference, Installation, Manufactured homes.

24 CFR Part 3286

Administrative practice and procedure, Consumer protection, Intergovernmental relations, Manufactured homes, Reporting and recordkeeping requirements.

Accordingly, for the reasons discussed in this preamble, HUD proposes to amend 24 CFR parts 3285 and 3286 as follows:

PART 3285—MODEL MANUFACTURED HOME INSTALLATION STANDARDS

1. The authority citation for part 3285 continues to read as follows:

Authority: 42 U.S.C. 3535(d), 5403, 5404, and 5424.

2. In § 3285.5, add a new definition for *Site* in alphabetical order to read as follows:

§ 3285.5 Definitions.

* * * * *

Site. An area of land upon which a manufactured home is installed.

* * * * *

3. In §3285.402 revise paragraph (a), redesignate paragraphs (b) and (c) as paragraphs (c) and (d), respectively, and add a new paragraph (b), to read as follows:

§ 3285.402 Ground anchor installations.

(a) Ground anchor certification and testing. Each ground anchor must be manufactured and provided with installation instructions, in accordance with its listing or certification. A nationally recognized testing agency must list, or a registered professional engineer or registered

architect must certify, the ground anchor for use in a classified soil, as discussed in § 3285.202, based on the test methods in paragraph (b) of this section, or a professional engineer or registered architect must certify that the ground anchor is capable of resisting all loads in paragraph (c) of this section.

(b) Standard test methods for establishing working load design values of ground anchor assemblies used for new manufactured home installations.

(1) Scope.

(i) These testing procedures provide standard test methods for establishing both ultimate loads and load resistance design values.

(ii) Each assembly or component of an anchor assembly must be tested by the methods established by this section, and, therefore, be suitable, as listed or certified for installation in an appropriately classified soil, for installation of manufactured homes.

(iii) To secure approval of ground anchor assembly products and components, ground anchor manufacturers must have their products tested and listed by a nationally recognized testing laboratory, or tested and certified by an independent registered professional engineer.

(iv) The testing laboratory or independent registered engineer must be free from any conflict of interest from the product manufacturer and any of the product manufacturer's affiliates.

(2) Definitions. The definitions contained in this section apply to the terms used in subpart E of this part.

Allowable displacement limits. Criteria establishing the maximum amount of displacement of a material, assembly, or component under load.

Certification Test Site. A site used for the purpose of anchor assembly qualification testing in accordance with this section.

Cohesive Soil. A soil with sufficient clay content to exhibit substantial plastic behavior when moist or wet (i.e., able to be readily molded or rolled into a 1/8-inch thread at a wide range of moisture contents).

Ground Anchor Manufacturer. Any person or company engaged in manufacturing or importing ground anchor assemblies.

Non-Cohesive Soil. Sand, gravel, and similar soils that are predominantly granular and lack a sufficient quantity of fine, clay-sized particles to exhibit the behavior of cohesive soil, as defined in this section.

Working anchor load. The ultimate anchor load in pounds divided by a factor of safety of 1.5.

Ultimate anchor load. The lower of either the highest load achieved during an individual test prior to failure due to exceeding allowable displacement limits or the load at failure of the anchoring equipment or its attachment point to the testing apparatus.

(3) Determination of Soil Classification.

(i) General Description of Soil Classification. The general description of soil classification shall be permitted by the use of the Table to § 3285.202.

(ii) Standards for Identification of Soil and Soil Classification. The soil test torque probe method must be used at the certification test site for soil classification. At a minimum, the soil test torque probe must be used at three sample locations representative of the extent of the certification site test area. Soil characteristics must be measured at a depth below ground surface of not greater than the anchor helix depth and not less than 2/3 of the anchor helix depth for each

ground anchor depth evaluated within the test area. The lowest torque probe value resulting in the highest soil classification number must be used. Additional guidance regarding the soil test torque probe method is available at the Appendix to this section and at § 3285.202.

(iii) Classification in Non-Cohesive Soils. Ground anchor assemblies must be tested and listed or certified, and labeled for use in non-cohesive soil. Ground anchor assemblies are permitted to be tested, listed or certified, and labeled for use in cohesive soil.

(4) Field testing apparatus.

(i) The testing equipment for conducting tests to list or certify a ground anchor assembly for use in a classified soil must be capable of meeting the requirements of paragraph (b)(7) of this section, as determined by the testing agency.

(ii) The testing equipment shall be calibrated to meet the testing requirements of paragraph (b)(7) of this section, as determined by the testing agency.

(5) Test specimens details and selection.

(i) Test specimens are to be examined by the independent testing, listing, or certifying entity for conformance with engineered drawings, specifications, and other information provided by the ground anchor manufacturer or producer including:

(A) Dimensions and specifications on all welds and fasteners;

(B) Dimensions and specifications of all metal or material;

(C) Model number and its location on the ground anchor; and

(ii) Necessary test specimens and products for the installed anchor assembly tests must be randomly selected by the independent testing, listing, or certifying entity.

(6) Test Requirements.

(i) Field tests must be performed on each anchor assembly installed in a classified soil as defined in paragraph (b)(3) of this section.

(ii) Field test apparatuses must be as specified in paragraph (b)(4) of this section and must conform to the testing requirements of paragraph (b)(7) of this section.

(iii) Testing equipment shall be adequate for testing as determined by the testing agency.

(7) Field Tests of Anchor Assemblies.

(i) The soil characteristics at the certification test site must be identified and recorded according to paragraph (b)(3) of this section. The date, approximate time, and names of persons conducting and witnessing the anchor assembly tests must also be recorded at each certification test site.

(ii) Connection of the testing apparatus to the anchor assembly head must provide loading conditions to the anchor head, similar to actual site conditions. Adequacy of the connection must be determined by the testing agency or test engineer.

(iii) For soil classifications 3, 4A, and 4B, testing must be performed in the lower 50 percentile torque probe value of the soil classification being tested. For soil classifications 1 and 2, the torque probe value must not exceed 750 inch-pounds.

Note to paragraph (b)(6): As a recommended practice, the test rig soil reactions (bearing pads) should not be located closer to the center of the anchor assembly (anchor head) than the lesser of D, 4d, or 32 inches where D is the depth of the anchor helix and d is the diameter of the anchor helix, both in inches. However, experience with a particular test rig, types of anchors, and soil conditions may justify other acceptable dimensional tolerances.

(iv) A minimum of three tests must be performed and the result of each test must meet or exceed 4,725 pounds pull (3,150 x 1.5 factor of safety) in the direction of pull.

(v) Special-purpose anchor assemblies, including those needed to accommodate unique design loads identified by manufacturers in their installation instructions, may be certified under this section or to more stringent requirements such as higher working loads, more restrictive anchor head displacements, and/or tested angle limitations.

(vi) Angle of Pull. Where the test apparatus configuration results in a changing angle of pull due to anchor assembly displacement during a lateral angle pull test, the angle of pull at the Ultimate Anchor Load is to be recorded as the load angle for the test. Load angles are to be measured relative to the plane of the ground surface and shall be permitted to be rounded to the nearest 5-degree increment.

(vii) Displacement Measurement. Vertical displacement (for all tests) and horizontal displacement (for lateral angle pull tests) must be measured relative to the centerline of the test apparatus' connection to the ground anchor assembly (anchor head) and the ground. A stable ground reference point for displacement measurements must be located independent of the test apparatus and not closer to the anchor assembly than the soil reaction points of the test apparatus. Displacement measurements shall be taken using a device with not less than 1/8-inch reading increments. Measurements shall be permitted to be rounded to the nearest 1/8-inch increment.

(8) Anchor assembly field test methods.

(i) An anchor assembly must be tested in accordance with one or more of the assembly configurations addressed in paragraphs (b)(7)(iii), (iv), and (v) of this section. The as-tested configuration of any anchor assembly is a condition of the listing or certification. Alternate configurations are acceptable provided test conditions appropriately simulate actual end-use conditions and the as-tested configuration is addressed in the manufacturer's installation instructions.

(ii) Anchor assemblies designed for multiple connections to the manufactured home must be individually tested as specified in paragraphs (b)(8)(iii) and (iv) of this section.

(iii) Anchor assembly/stabilizer plate method. The following anchor assembly installation and testing must be consistently applied for all tests:

(A) The ground anchor is to be installed at an angle of 10-15 degrees from vertical to a depth of one-half ($\frac{1}{2}$) to two-thirds ($\frac{2}{3}$) of the anchor length.

(B) A stabilizer plate is to be driven vertically on the side of the ground anchor shaft facing the tensioning equipment three inches (3") from the shaft, and the top of the plate must be installed flush with the soil surface or not more than one inch below the soil surface.

(C) The ground anchor is to be driven to its full depth into the soil with the bottom of the anchor head not more than $\frac{3}{4}$ inch above the stabilizer plate.

(D) The ground anchor head is to be attached to the tensioning equipment such that the tension load and displacement can be recorded. The tensioning equipment must be positioned to load the ground anchor and stabilizer plate at the minimum angle to the test site ground surface for which the anchor is being evaluated.

Note to paragraph (b)(8). Additional testing at angles of pull greater than the minimum angle of pull may be used to provide design values for specific angles of pull greater than the minimum angle for which evaluation is sought.

(E) The ground anchor is to be pretensioned to 500 pounds so that the anchor shaft contacts the stabilizer plate. If the anchor shaft does not come into contact with the stabilizer plate, an anchor setting load not to exceed 1,000 pounds is permitted to be applied and then released prior to reapplication of the 500-pound pretension force.

(F) The location of the ground anchor head is to be marked after it is pretensioned for measuring subsequent movement under test loading.

(G) Increase the load throughout the test. The recommended rate of load application must be such that the loading to not less than 4725 pounds is reached in not less than 2 minutes from the time the 500 pound pretension load is achieved.

(H) Record the load and displacement, at a minimum of 500-1000 pound increments, such that a minimum of five data points will be obtained to determine a load deflection curve. For each datum, the applied load and the ground anchor head displacement is to be recorded. In addition, the load and displacement is to be recorded at the failure mode identified in paragraph (b)(10) of this section. It is permissible to halt the addition of load at each loading increment for up to 60 seconds to facilitate taking displacement readings. The ultimate anchor load of the ground anchor assembly and corresponding displacement is to be recorded. The pretension load of 500 pounds should be included in the 4725 pound ultimate anchor load test. It is permissible to interpolate between displacement and load measurements to determine the ultimate anchor load.

(I) All ground anchor assemblies must be tested to the following:

(1) Failure due to displacement of the ground anchor assembly as established in paragraph (b)(9) of this section, or

(2) Failure of either the anchoring equipment or its attachment point to the testing apparatus, or to a minimum of 4725 pounds (when possible, tests should be taken to 6000 pounds to provide additional data, but this is NOT required).

(iv) Vertical in-line anchor assembly method. Anchor assembly installation and withdrawal procedures for test purposes are to be as follows, and are to be used consistently throughout all tests:

- (A) The ground anchor must be installed vertically.
- (B) The ground anchor must be driven to its full depth into the soil.
- (C) The ground anchor head must be attached to the tensioning equipment such that the load and ground anchor head displacement can be recorded.
- (D) The ground anchor must be pulled in line with the ground anchor shaft.
- (E) The ground anchor shall be pretensioned to 500 pounds.
- (F) The location of the ground anchor head must be marked after it is pretensioned for measuring subsequent movement under test loading.
- (G) Increase the load throughout the test. The recommended rate of load application shall be such that the loading to not less than 4725 pounds is reached in not less than 2 minutes from the time the 500 pound pretension load is achieved.
- (H) Record the load and displacement, at a minimum of 500-1000 pound increments, such that a minimum of five data points will be obtained to determine a load deflection curve. For each datum, the applied load and the ground anchor head displacement is to be recorded. In addition, the load and displacement is to be recorded at the failure mode identified in paragraph (b)(10) of this section. It is permissible to halt the addition of load at each loading increment for up to 60 seconds to facilitate taking displacement readings. The ultimate anchor load of the ground anchor assembly and corresponding displacement is to be recorded. The pretension load of 500 pounds should be included in the 4725 pound ultimate anchor load test. It shall be

permissible to interpolate between displacement and load measurements to determine the ultimate anchor load.

(I) All ground anchor assemblies must be tested to the following:

(1) Failure due to displacement of the ground anchor assembly, as established in paragraph (b)(9) of this section, or

(2) Failure of either the anchoring equipment or its attachment point to the testing apparatus, or to a minimum of 4725 pounds (when possible, tests should be taken to 6000 pounds to provide additional data but this is NOT required).

(v) In-line ground anchor assembly method. Ground Anchor Assembly installation and withdrawal procedures for test purposes must be as follows, and must be used consistently throughout all tests:

(A) The ground anchor must be installed at an angle from the horizontal ground surface at which it is to be rated.

(B) The ground anchor must be driven to its full depth into the soil.

(C) The ground anchor head must be attached to the tensioning equipment such that tension and displacement can be recorded.

(D) The anchor must be pulled in line with the ground anchor shaft.

(E) The ground anchor shall be pretensioned 500 pounds.

(F) The location of the ground anchor head is to be marked after it is pretensioned for measuring subsequent movement under test loading.

(G) Increase the load throughout the test. The recommended rate of load application must be such that the loading to not less than 4725 pounds is reached in not less than 2 minutes from the time the 500 pound pretension load is achieved.

(H) Record the load and displacement, at a minimum of 500 -1000 pound increments, such that a minimum of five data points will be obtained to determine a load deflection curve. For each datum, the applied load and the ground anchor head displacement are to be recorded. In addition, the load and displacement are to be recorded at the failure mode identified in paragraph (10) of this section. It shall be permissible to halt the addition of load at each loading increment for up to 60 seconds to facilitate taking displacement readings. The ultimate anchor load of the ground anchor assembly and corresponding displacement must be recorded. The pretension load of 500 pounds should be included in the 4725 pound ultimate anchor load test. It is permissible to interpolate between displacement and load measurements to determine the ultimate anchor load.

(I) All ground anchor assemblies must be tested to the following:

(1) Failure due to displacement of the ground anchor assembly as established in paragraph (b)(9) of this section, or

(2) Failure of either the anchoring equipment or its attachment point to the testing apparatus, or to a minimum of 4725 pounds (when possible, tests should be taken to 6000 pounds to provide additional data, but this is NOT required)

(9) Failure criteria. The following conditions constitute failure of the ground anchor test assembly:

(i) When the ground anchor head, or its attachment point, displaces 2 inches in the vertical or horizontal direction from its pretensioned measurement position prior to reaching a total load of 3150 pounds (including any pretension load).

(ii) When the ground anchor head, or its attachment point, displaces 2 inches in the vertical direction or 3 inches in the horizontal direction from its pretensioned measurement position prior to reaching a total load of 4725 pounds (including any pretension load).

(iii) When breakage of any component of the ground anchor shaft occurs prior to reaching a total load of 4725 pounds.

(10) Use of ultimate anchor loads to establish the working load design value.

(i) The working load design value is the lowest ultimate anchor load determined by testing, divided by a 1.5 factor of safety.

(ii) The working load design value, for each installation method and soil classification, shall be stated in the ground anchor assembly listing or certification. An anchor tested in a given soil classification number must not be approved for use in a higher/weaker soil classification number. For example, an anchor tested in soil classification 3 must not be approved for soil classification 4A or 4B unless it is also tested in those soils. The 500 pound pretension is included in the ultimate anchor load.

(11) Test Report. The test report to support the listing or certification for each ground anchor assembly tested is to include all conditions under which the ground anchor assembly was tested, including the following:

(i) A copy of all test data accumulated during the testing.

(ii) The soil characteristics, including moisture content and methods for determining soil characteristics, for each type of soil for which the ground anchoring assembly was evaluated.

(iii) The model of the ground anchor assembly tested.

(iv) The ground anchor assembly test method used.

(v) Detailed drawings including all dimensions of the ground anchor assembly and its components.

(vi) Method of installation at the test site.

(vii) Date of installation and date of testing.

(viii) Location of the certification test site.

(ix) Test equipment used.

(x) A graph or chart for each anchor specimen tested indicating the loading increments in pounds and resulting displacement in inches.

(xi) The working load design value and ultimate anchor load, determined in accordance with paragraph (b)(10) of this section.

(xi) If required, a description of the stabilizer plate used in each ground anchor assembly/stabilizer plate test, including the name of the manufacturer.

(xii) Angle(s) of pull for which the anchor has been tested.

(xiii) Embedment depth of the ground anchor assembly.

(xiv) The application and orientation of the applied load.

(xv) A description of the mode and location of failure for each ground anchor assembly tested.

(xvi) Name and signature of the nationally recognized testing agency or registered professional engineer certifying the testing and evaluation.

(xvii) The soil classification(s) for which each ground anchor assembly is certified for use and the working load design value and minimum ultimate load capacity for those soil classification(s).

(12) Approved ground anchor assemblies. Each ground anchor manufacturer or producer must provide the following information for use of approved ground anchor assemblies, and this information must also be included in the listing or certification for each ground anchor assembly:

- (i) Drawings showing ground anchor installation.
- (ii) Specifications for the ground anchor assembly including:
 - (A) Soil classifications listed or certified for use;
 - (B) The working load and minimum ultimate anchor load capacity for the anchor assembly in the soil classification(s) for which it is listed or certified for use;
 - (C) Model number and its location on the anchor;
 - (D) Instructions for use, including pretensioning;
 - (E) Angle(s) of pull for which the anchor has been listed and certified; and
 - (F) Manufacturer, size, and type of stabilizer plate required.

Appendix to § 3285.402

Torque Probe Method for determining soil classification: This kit contains a 5-foot-long steel earth-probe rod, with a helix at the end. It resembles a wood-boring bit, on a larger scale. The tip of the probe is inserted as deep as the bottom helix of the ground anchor assembly that is being considered for installation. The torque wrench is placed on the top of the probe. The torque wrench is used to rotate the probe steadily so one can read the scale on the wrench. If the torque wrench reads 551 inch-pounds or greater, then a class 2 soil is present according to the Table to 24 CFR 3285.202(a)(3). A class 3 soil is from 351 to 550 inch-pounds. A class 4A soil is from 276 to 350 inch-pounds, and a class 4B soil is from 175 to 275 inch-pounds. When the torque wrench reading is below 175 inch-pounds, a professional engineer should be consulted.

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**PART 3286—MANUFACTURED HOUSING INSTALLATION RULES AND
REGULATIONS**

4. The authority citation for part 3286 continues to read as follows:

Authority: 42 U.S.C. 3535(d), 5404, and 5424.

5. Revise § 3286.505 paragraph (e) to read as follows:

§ 3286.505 Minimum elements to be inspected.

* * * * *

(e) Anchorage including verification that the ground anchors have been installed in accordance with the manufacturer's instructions, in a soil classification permitted by the anchor listing or certification, with the required size and type of stabilizer plate, if required by the listing or certification, and at an orientation and angle of pull permitted by its listing or certification.

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Dated: June 20, 2013

Carol J. Galante
Assistant Secretary for Housing – Federal
Housing Commissioner

[FR-5631-P-01]

[FR Doc. 2013-18001 Filed 07/25/2013 at 8:45 am; Publication Date: 07/26/2013]